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ABSTRACT

New findings about child nutrition and cognitive development indicate that undernourished children are typically fatigued and uninterested in their social environments. Such children are less likely to establish relationships or to explore and learn from their surroundings. Undernourished children are also more susceptible to illness and, thus, more likely to be absent from school. These factors result in a loss of opportunities for undernourished children and in a loss of contributions to society. An overview of research reveals that children in the United States suffer a mild to moderate degree of malnourishment associated with poverty. A combination of environmental insults and undernutrition has been shown to result in growth retardation and developmental delays. Unless irreparable physiological damage has occurred, improvements in environment and nutrition can rectify the developmental effects to which a young child is exposed. Nutrition programs such as the Special Supplemental Food Program for Women, Infants, and Children (WIC), the School Breakfast Program, the School Lunch Program, the Summer Food Service Program and the Food Stamp Program play key roles in safeguarding the health and cognitive develop of children who are at risk for undernutrition. Addition benefits provided by these programs include savings in medical costs and savings in special education programs. (VL)

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Center on Hunger, Poverty and Nutrition

Tufts University
School of Nutrition

Statement on

The Link Between Nutrition and Cognitive Development in Children

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We express appreciation to the National Advisory Committee of the Nutrition-Cognition Initiative. The work products of this undertaking, however, are those of the Center and do not necessarily reflect the views of the advisors themselves.

1994

The Nutrition-Cognition Initiative

The Nutrition-Cognition Initiative is a program of the Center on Hunger, Poverty and Nutrition Policy at Tufts University School of Nutrition. Its purpose is to broaden public awareness about the known relationship between nutrition and cognitive development, and to enable policymakers to incorporate this knowledge into public policies which protect vulnerable youngsters. While current research conclusively shows the links between poverty, nutrition and cognition, much of this research is recent enough that it has not yet been incorporated into public policies designed to protect American children.

The Initiative's activities and publications are designed for several constituencies including national experts, policymakers, corporate executives and the media.

Over the course of two years the Center will:

- Host a national working conference for researchers and policymakers.
- Run a series of luncheons on Capitol Hill for members of Congress and the Executive branch and their staff.
- Help provide expert opinion for Congressional hearings on the subject.
- Publish two reports, one summarizing the relationship between nutrition and cognition, and the other offering general policy directions for the future.

Support for the Center's work in the area of nutrition and cognitive development in children is provided by a grant from Kraft General Foods.

Additional funding for this work is provided by Share Our Strength and Hasbro Children's Foundation.

Laura P. Sherman, Project Director

Like other scholars in the field, my research has carried me across the world to observe and analyze the effects of child malnutrition. Over several decades we have built a compelling body of scientific knowledge about this severe problem.

We have now learned that even moderate undernutrition, the type seen most frequently in the United States, can have lasting effects on the cognitive development of children. Inadequate nutrition is a major cause of impaired cognitive development, and is associated with increased educational failure among impoverished children. While this relationship is recognized more and more by child development specialists, educators, and nutritionists, it is not well known among the general public. Neither have recent findings about this relationship been incorporated adequately into the nation's public policies.

The primary factor associated with poor nutritional status in this country is poverty, the inadequacy of family resources. Child poverty in the United States has been increasing at an alarming rate over the past decade. This increase, coupled with the known link between poverty, nutritional status and the cognitive development of children, suggests that our country may be heading for a crisis of enormous proportions. It is critical that we examine the effectiveness of public policies designed to protect and nurture disadvantaged children.

New research findings highlighted in this document give us a much clearer understanding of how children are harmed by undernutrition, and how we can help them. The challenge now is to incorporate this new knowledge into programs and policies which improve the nutritional status and cognitive development of our most vulnerable youngsters. The "Statement on the Link Between Nutrition and Cognitive Development in Children" is an important step in bringing this important knowledge before the American public and its leaders.

Dr. Ernesto Pollitt
Professor of Pediatrics

University of California, Davis

Foreword

I am pleased to present to policymakers and the public this document which describes the latest research on the relationship between nutrition and children's cognitive development. The existing body of research shows a clear threat to the intellectual development of children who do not receive adequate nutrition. Except for the most extreme cases, however, damage caused by inadequate nutrition need not be permanent. This knowledge strongly argues for policies and programs that prevent or mediate the effects of undernutrition on children's development.

It is now known that from the moment of conception onward, inadequate nutrition threatens the behavioral and cognitive development of young children. Not surprisingly, children who suffer from inadequate nutrition also typically suffer from a range of other environmental insults associated with poverty. Poor housing, inadequate health care, unemployment and weakened family and community support systems all interact with undernutrition to impede a child's healthy development.

Compelling new research points to the need for comprehensive programs to improve children's welfare. It is not enough to expect that a child's opportunities will improve simply by addressing health care, or education, or housing. Nor is it enough to address children's nutritional needs alone. This document explains why the nutritional status of children is a critical factor in their development. It is our hope that by making scientific knowledge in this field more accessible to policymakers, recent research findings will strengthen public efforts to protect American children.

Our nation stands at an auspicious moment. Top leaders have made a commitment to invest in people to preserve our nation's economic and moral strength. While language like "investing in children" may be new to many people, it also may be the most important phrase by which to shape domestic policy. Increasing numbers of corporate CEOs, for example, note the strong link between our nation's future and the health and well-being of our children. Protecting children's health and cognitive development may be the best way to build a strong America. Achieving this goal, especially in light of the new research findings summarized in this document, is the challenge and opportunity now before us.

Dr. J. Larry Brown
Director

Center on Hunger, Poverty and Nutrition Policy
Tufts University School of Nutrition

New Findings About Child Nutrition and Cognitive Development

Recent research provides compelling evidence that undernutrition during any period of childhood can have detrimental effects on the cognitive development of children and their later productivity as adults. In ways not previously known, undernutrition impacts the behavior of children, their school performance, and their overall cognitive development. These findings are extremely sobering in light of the existence of hunger among millions of American children.

Undernutrition harms children silently. Even before it is severe and its results are readily detectable, inadequate food intake limits the ability of children to learn about the world around them. When children are chronically undernourished their bodies conserve the limited food energy available. Energy is first reserved for maintenance of critical organ function, second for growth, and last for social activity and cognitive development. As a result, undernourished children decrease their activity levels and become more apathetic. This in turn affects their social interactions, inquisitiveness and overall cognitive functioning.

Even nutritional deficiencies of a relatively short-term nature influence children's behavior, ability to concentrate, and to perform complex tasks. Deficiencies in specific nutrients, such as iron, have an immediate effect on the ability to concentrate. Child hunger, defined by inadequate nutrient intake during the early years, is capable of producing progressive handicaps — impairments which can remain throughout life.

This evidence suggests that undernutrition costs far more than the diminished well-being of youngsters during childhood. By robbing children of their natural human potential, undernutrition results in lost knowledge, brainpower and productivity for the nation. The longer and more severe the malnutrition, the greater the likely loss and the greater the cost to our country.

Undernutrition begins to exact its toll even before the child is born. Pregnant women who are undernourished are more likely to have low birthweight babies. Along with other health risks that are common to low birthweight babies, these infants are more likely to suffer developmental delays. In the case of very low birthweight infants, permanent cognitive deficiencies associated with smaller head circumference may reflect diminished brain growth.

Research shows that increasing independence and the development of social skills are central to a child's early development. When these activities are curtailed due to undernutrition, a child's overall cognitive development is threatened. Undernourished children typically are fatigued and uninterested in their social environment. Compared with their well-nourished peers, they are less likely to establish relationships or to explore and learn from their surroundings.

When children reach school age, developmental delays associated with pre- and post-natal malnutrition often result in a greater need for costly special education services. Undernourished children also are more susceptible to illness and therefore more likely to be absent from school. Children who attend school hungry have diminished attention spans and are unable to perform tasks as well as their nourished peers. In these cases, the full value of the education provided is lost.

Anemia is one of the most prevalent nutritional disorders in the world, affecting nearly one quarter of all low income children in the United States. Recent research shows that iron deficiency anemia has an adverse effect on a child's ability to learn by influencing attention span and memory. This pervasive deficiency is now known to have a severe impact on cognitive development.

Beyond its independent effect on cognitive development, iron deficiency anemia puts children at higher risk of lead poisoning. Scientific evidence shows that high lead levels result in neurodevelopmental disorders. Low-income children face a double jeopardy — they are more likely to be anemic and more likely to live in an environment where the risk of lead poisoning is high.

Lost Opportunities

Perhaps the greatest costs associated with undernutrition among children are the more intangible ones. In economic terms, these are "opportunity costs" — the costs of lost opportunity in which productivity with financial benefits would otherwise occur. In this area, the lost opportunity is the contribution that nutritionally-deprived children might otherwise make to society as a whole, and to the productivity and well-being of their families in adult life.

The lifelong effects of chronic undernutrition are cognitive limitations and behavioral impairments that restrict educational experiences and later adult productive capacity. One of the better predictors of a person's lifetime productivity is the number of years of school completed. Poor performance early in school is a major risk factor for dropping out of school in later years. Nutritionally deprived children are unable to benefit fully from schooling which, in turn, diminishes their potential as adults. This is a cost the nation pays indirectly through lost contributions, and directly through the provision of additional social welfare services.

With this greater understanding of the serious threats posed by even mild undernutrition in childhood comes a "silver lining." Unlike some social and health problems plaguing our young, undernutrition is preventable and its effects often modifiable. Many existing programs and treatments are known to be effective. Nutrition and prenatal care for women reduces the incidence of low birthweight babies and subsequent developmental delays associated with that condition. Iron repletion therapy can reverse some of the effects of anemia on learning, attention and memory. And research consistently establishes that federal initiatives such as the School Breakfast Program and the Special Supplemental Food Program for Women, Infants and Children (WIC) have positive effects on the cognitive development of children. The benefits include higher performance on standardized tests, better school attendance, lowered incidence of anemia, and reduced need for costly special education.

Overview Of Recent Research Findings

A body of scientific evidence – some of it very recent – points to a highly compelling link between nutritional intake and cognitive development in children. Much of the human research in this area has been conducted in developing countries where undernutrition is severe, identified by kwashiorkor (protein deficiency), and marasmus (protein/calorie deficiency).

The degree of undernutrition identified most often in the United States is mild-to-moderate undernutrition. Typically it is caused by inadequate nutrient intake which can result in conditions such as iron deficiency anemia. On a longer-term basis it may result in actual growth retardation, where the child's body stops growing as reflected in diminished weight or height for age. While it is not appropriate to conclude that mild undernutrition has the same effects as severe malnutrition, conditions associated with the milder forms of undernutrition more typically experienced by poor children in the U.S., do pose a serious threat to children's well-being.

Evidence from developing countries regarding the relationship between undernutrition, poverty and cognitive development are relevant to our understanding of the effects of undernutrition in the United States. Moreover, international studies of treatment and preventive programs can provide useful information for approaches we may take in the United States to better protect the cognitive development of our children.

Current Scientific Research Links Nutrition and Cognitive Development

- Undernutrition along with environmental factors associated with poverty can permanently retard physical growth, brain development, and cognitive functioning.
- The longer a child's nutritional, emotional and education needs go unmet, the greater the likelihood of cognitive impairments.
- Iron deficiency anemia, affecting nearly 25 percent of poor children in the United States, is associated with impaired cognitive development.
- Poor children who attend school hungry perform significantly below non-hungry low income peers on standardized test scores.
- There exists a strong association between family income and the growth and cognitive development of children.
- Improved nutrition and environmental conditions can modify the effects of early undernutrition.
- Iron repletion therapy can reduce some of the effects of anemia on learning, attention and memory.
- Supplemental feeding programs can help to offset threats posed to the child's capacity to learn and perform in school which result from inadequate nutrient intake.
- Once undernutrition occurs, its long-term effects may be reduced or eliminated by a combination of adequate food intake and environmental (home, school) support.

Scientific understanding of the nutrition-cognition relationship has evolved over time. Early studies on the relationship between nutritional deficits and brain function were guided by a "main effect" theory. The theory held that early exposure to a biological risk factor such as undernutrition during critical periods of brain growth could result in actual neurological trauma and permanent developmental abnormalities. The extent of neurological damage was thought to be directly related to the magnitude of undernutrition.

Recent evidence indicates that malnutrition alone does not necessarily cause cognitive alterations. Studies reveal differences, for example, in the cognitive functioning of children suffering from malnutrition due to illness, compared to children malnourished due to dietary deficiencies associated with poverty. Children malnourished due to illness generally do not show developmental delays associated with their malnutrition, whereas such delays are evident among malnourished children living in poverty.

Many researchers no longer emphasize that malnutrition alone causes irreversible damage to the brain. This indicates that the mechanism causing long-term cognitive impairment is not necessarily alteration of brain structure itself, although evidence is insufficient to rule out structural damage altogether.

Cognitive deficits related to undernutrition are now believed to result from complex interactions between environmental insults and undernutrition. A cumulative effect of persistent exposure to undernutrition and poverty has been shown clearly. The longer a child's nutritional, emotional and educational needs go unmet, the greater the overall cognitive deficits. Continuous low nutritional intake, for example, usually affects psychological factors such as motivation, attentiveness and emotional expression. These in turn may have a negative effect on critical developmental processes including parent-child interaction, attachment, play and eventually learning. But unless major and irreparable physiological insult has occurred, improved nutrition and conditions in the social environment can modify the developmental effects of biological and social risk factors to which the child is exposed in early life.

In addition to favorable qualities in a child's environment, nutritional supplementation can modify and, in some instances rectify, cognitive impairment caused by earlier undernutrition. A study of children malnourished during pregnancy showed that those children who received only standard medical care displayed cognitive and interpersonal performance deficits until at least age three. In comparison, malnourished infants who received both nutritional supplementation and post-natal environmental stimulation were indistinguishable in cognitive or interpersonal functions from adequately nourished children.

In another study of malnourished children being rehabilitated through nutritional supplementation and play therapy, researchers examined the benefits of continuing the play therapy after nutritional rehabilitation was no longer necessary. The greatest and most lasting improvements were shown by children who continued to receive play therapy for several years after their nutritional therapy was completed.

In general new research findings show that lack of sufficient food during childhood, even on a relatively mild basis, is far more serious than previously thought. It can produce cognitive impairments in children which may last a lifetime. But the evidence also suggests that adequate nutrition can prevent many of these undesirable outcomes, and is capable of modifying harm that actually has occurred.

The Role Of Key Nutrition Programs For Children

Our nation has in place a network of nutrition programs that were developed with the underlying aim to protect all citizens who are vulnerable to the harmful effects of hunger. Several key programs focus directly on ensuring that the most vulnerable children do not go hungry as a way to protect their healthy development and later productivity as adults.

The major nutrition programs targeted to children are described below. Research findings suggest that each program has significant potential to safeguard cognitive development, and to help protect good health in early years.

Special Supplemental Food Program for Women, Infants, and Children (WIC)

The Supplemental Food Program for Women, Infants, and Children (WIC) safeguards the health of pregnant, postpartum and breastfeeding women, infants, and children under five years of age. Household income must be below the eligibility level (no more than 185 percent of the poverty level), and participants must be at nutritional risk, based on abnormal weight gain during pregnancy, iron-deficiency anemia or related health risks. About 60 percent of those eligible for WIC receive its benefits.

The WIC program, authorized by Congress in 1972, was envisioned as a preventive program, providing foods, nutrition education and improved access to health care in order to reduce nutrition-related health problems during critical periods of growth and development. The WIC program is funded by the federal government, but some states supplement the federal allocation for WIC.

WIC Research: The Benefits of Prevention

Research indicates that WIC is highly cost-effective. Data from several studies has demonstrated that by decreasing the number of low birthweight babies born and the need for hospital care for these infants, medical costs are reduced. A 1990 U.S. Department of Agriculture study showed WIC spending on pregnant women was associated with substantial savings in Medicaid costs for newborns and their mothers during the first 60 days after birth. Every $1 spent on the prenatal component of WIC yielded an average savings of about $3 in Medicaid.

A 1992 study released by the Government Accounting Office (GAO) in the Spring of 1992, found that the prenatal benefits of the Special Supplemental Food Program for Women, Infants and Children (WIC) resulted in cost savings to other federal, state and local programs over the first 18 years of the lives of children. The study concluded that for every $1.00 spent on WIC, $3.50 is saved by averting medical and other related expenditures. This demonstrates how the prevention of problems through the provision of adequate childhood nutrition is a sound investment for the nation.

The greatest cost savings associated with the WIC program are recognized during the first year of life in the form of reduced medical costs. The study also recognized long-term benefits of the WIC program, which include protection of a child's cognitive development. Among these are savings for special education that may have otherwise been required had the child not received adequate nutrition during pregnancy.

In a 1993 joint analysis of data in the Pediatric Surveillance System conducted by the National Center for Chronic Disease Prevention (CDC) and the Food Research and Action Center, the WIC program was shown to reduce the level of anemia among participating preschool children. Every year during the period 1982 to 1992, there was a decrease in the rate of anemia between an initial screening when children first entered the WIC program, and a follow-up visit done later in the same year. The decrease in the rate of anemia is statistically significant over time for all age groups studied — children ages six months to five years. Specifically, this data shows that WIC has a positive effect on older participating children. There was an average of a 17 percent decrease in the rate of anemia from initial WIC screening to follow-up for three-year-old children and an average of a 20 percent decrease for four-year old children. The fact that WIC helps to reduce anemia, a nutritional problem affecting one in four low-income children, means that it helps protect children from the behavioral and cognitive deficiencies associated with anemia, described earlier in this article.

School Breakfast

The School Breakfast Program provides federal funds to schools and residential child care institutions to offer nutritious meals to students. Children from households with incomes between 130 and 185 percent of the poverty level receive meals at reduced rates; students from households with incomes 130 percent of poverty and below receive meals free.

Although the School Breakfast Program is an entitlement program (meaning federal funds are available to pay its costs), it is not accessible to many children who need it because most school districts are not required to offer it. Fewer than half of the nation's schools that offer lunch also offer breakfast.

The School Breakfast Program is administered nationally by the Child Nutrition Division of the Food and Nutrition Service of the U.S. Department of Agriculture. In most states, the state Department of Education administers the program.

Research on the Benefits of School Breakfast

In 1987, Meyers, Sampson, et al, examined the effect of the School Breakfast Program on school performance of low-income elementary school children in Lawrence, Massachusetts. The researchers were presented with a unique opportunity to test the effects of the School Breakfast Program on children for whom it was newly available. The researchers measured children's scores on standardized achievement tests as well as rates of lateness and absences prior to the implementation of the program. These variables were measured a year later (as well as three months after implementation of the school breakfast program). Children who participated in the School Breakfast Program were shown to have significantly higher standardized achievement test scores than eligible non-participants. Children getting school breakfast also had significantly reduced absence and tardiness rates.

These research findings show that participation in the School Breakfast Program is associated with significant improvements in academic functioning among low-income elementary school children. The researchers attribute the academic improvements to the effects of a morning meal and to the longer term benefit of an improved dietary intake.

School Lunch

Authorized by the Child Nutrition Act in 1946 to "safeguard the health and well-being of the nation's children", the National School Lunch Program is an entitlement program open to all public and non-profit private schools and all residential child care institutions. The Program is administered by the Department of Agriculture, in conjunction with state education agencies and local education agencies. Lunch is available to all children at participating schools, and the meals must meet specific nutritional requirements in order to qualify for federal funds.

Household income is used to determine whether a child will pay a substantial part of the cost for their lunch or will receive a reduced-price or free meal. To receive a reduced-price meal, household income must be below 185 percent of the federal poverty level. For free meals, household income must fall below 130 percent of poverty. Children in food stamp households or AFDC assistance units are automatically eligible for free meals.

Research on the School Lunch Program

USDA research shows that children who participate in the school lunch program have superior nutritional intake compared to those who do not. Studies also show that low-income children depend on the School Lunch Program for one-third to one-half of their nutritional intake each day. These findings indicate that this program is highly significant insofar as protecting the nutritional status of most participating low-income children.

Summer Food Service Program

The Summer Food Service Program provides meals to low-income children in the summer months and during vacation periods. Sponsoring sites include public or private nonprofit organizations such as schools, Boys and Girls Clubs, churches and YMCAs. Eligible sponsors of the Summer Food Program must be located in areas where the majority of children are low income and meals must meet specific nutritional requirements. All meals are free to participating children regardless of household income.

Many poor children rely upon the school lunch and breakfast programs for a major portion of their daily nutrition during the school year. However, during the summer many children miss out on necessary nutrition because there are not enough summer food programs operating where eligible children live. In 1992, only 15.5 percent of the low-income children who participated in the school lunch program also received summer meals.

Research Needed to Establish Program Impact

There is a strong need for a greater body of scientific research into the impact of this program. While there is research which strongly points to the importance of this program, more attention needs to be devoted to the program as a means to protect the nutrient status of low-income youngsters during the summer months when they do not receive school breakfast or lunch. It is highly likely that, in the absence of school meals during the summer, the Summer Food Program plays a critical role in helping low-income youngsters achieve their nutrient needs. This is especially so given findings on the importance of school meals themselves which, during the summer, are not available. But further research is needed to establish this relationship, and to determine whether summer programs are an adequate supplement to meet children's nutrient needs during summer months.

The Food Stamp Program

The Food Stamp Program is the nation's first line of defense against acute hunger. The fundamental mission of the Program is to help low-income people buy food to improve their diets. Half of all food stamp participants are children and 87 percent are children, the elderly or women. The program operates as an entitlement: any household meeting the eligibility requirements is entitled to receive food stamps. To qualify, households must have gross incomes below 130 percent of the official poverty value of assets such as automobiles.

The Food Stamp Program was established in 1964 and now operates in every county of the United States. The program is administered nationally by the U.S. Department of Agriculture and on the state and local level by welfare or human service agencies. The federal government pays the full cost of food stamps and at least half of the program's administrative costs, with state and local governments paying the remainder.

Research Findings on the Food Stamp Program

A sizeable body of research establishes the Food Stamp Program as a central component in helping low-income households achieve better nutritional intake. Recipient households attain a significantly larger proportion of recommended dietary allowances (RDAs) than do eligible non-participants. Nevertheless, weaknesses exist. Four of five recipients fail to reach established RDA standards on the average allotment of .70 cents per person per meal. Moreover, GAO studies have found that bureaucratic obstacles prevent up to a quarter of eligible households from receiving the coverage to which they are entitled. Finally, because of the cost and size of this program, ongoing research is needed to assess its impact and cost-effectiveness.

Corporate Commitment To Address Nutritional Deficiencies Among Children

On March 6, 1991, five corporate executives testified before the House Budget Committee in support of a special food program for low-income mothers and children.

In a joint statement they said:

"We're convinced that WIC - the Special Supplemental Food Program for Women, Infants, and Children - can make an important contribution to ensuring that the nation's education objectives are met, and that in turn, we have the productive workforce we need."

Robert E. Allen, Chairman and Chief Executive Officer, AT&T

"... There is no freedom in the poverty and ignorance that many American children today endure; no privileges-in-waiting. There's only the sure, sad realization that we are letting those children down; that we have slowly and perhaps unwittingly, compromised not only their futures but ours as well..."

John L. Clendenin, Chairman and Chief Executive Officer, Bell South Corporation

"... Nothing is more important to the future of our country as a whole than the futures of our children. And for thousands of children across the country, nothing is more important to their long-term health and well-being than WIC..."

Dr. James J. Renier, Chairman and Chief Executive Officer, Honeywell, Inc.

"It is clear to business people that if we fail to nurture and educate all of our children, we will close the doors of the future to the growing number of young people, who, today, are excluded from the mainstream of our society."

Robert C. Winters, Chairman and Chief Executive Officer, The Prudential Insurance Company of America

"...But we should invest our health care dollars where they will do the most good. That means in prevention. We need to start preparing our children today so they can lead productive and meaniful lives tomorrow..."

William S. Woodside, Chairman, Sky Chefs, Inc.

"... I'm a firm believer in reducing the deficit, and as an economist, I share with you the conviction that our fiscal problems must be faced squarely. But the poor children whose lives may be altered by whether they gain entry into WIC are not the individuals responsible for the deficit...Our neglect of children not only damages them — it is counterproductive for our society."

Corporate Commitment To Address Nutritional Deficiencies Among Children

Again, on June 23, 1992, a group of corporate executives met with leaders on Capitol Hill to urge immediate action to address growing hunger among American children. At a House Budget Committee and Select Committee on Hunger press conference they released a joint statement, signed by over 25 corporate executives, in support of the Mickey Leland Childhood Hunger Relief Act.

These 25 plus corporate leaders declared:

"...We should wait no longer to end hunger. If we do not act now, we will bear its cost twice: now and in the future. The most important step right now if for Congress to fund the Leland Act. It is a wise investment..."

In individual statements at the press conference the corporate executives said:

Alan G. Hassenfeld, Chairman and Chief Executive Officer, Hasbro, Inc.

"...Investment in the eradication of hunger today is a good business decision. If we fail to make this investment, it is doubtful that we can sustain healthy economic growth. Without this investment, our nation may disintegrate into a country sharply divided between those who have enough to eat and those who do not."

Arnold Hiatt, Chairman, The Stride Rite Foundation

"...Growing numbers of corporate executives are aware of the inextricable link between the well-being of our families and the well-being of our nation. Nowhere is this link manifest so strongly as with the problem of hunger."

Vidal Sassoon, President, The Vidal Sassoon Foundation

"Eliminating hunger is a fundamental requirement for a strong America... We should not wait any longer. The U.S. can become a world leader again, but only with a strong economy and a healthy population. By passing the Mickey Leland Childhood Hunger Relief Act, government can begin immediately to revitalize our America."

Conclusion

It is now known that inadequate nutrition harms the cognitive development of children in ways that may produce lasting damage.

While further research will help to answer questions about the effects of specific nutrients on cognitive functioning, scientific knowledge has established the importance of ensuring adequate nutrition for all children. Undernutrition is closely associated with poverty, and the effects of undernutrition are made worse by the range of socio-environmental insults that often accompany poverty. With 14.3 million children living in poverty in 1991, millions of them experiencing hunger, addressing undernutrition is a critical challenge in the U.S.

Unfortunately, the effects that poor health and nutrition have on learning and educability are often not incorporated into efforts to improve our education system. Key education problems such as drop-outs or school failure are rarely examined in terms of the health and nutritional status of poor children.

Many of our nation's leaders now recognize that the well-being of millions of children is in jeopardy. A number of business leaders, political leaders, medical professionals, educators and others have recently called for a new focus on children's welfare. Recognizing the nutritional risk faced by poor children (and ultimately the risk faced by our nation through denying these children opportunities), top leaders now call for "investing in America" through protecting children.

Growing numbers of corporate leaders point to the need to improve America's competitive strength through strategic investment in the well-being of our children. Many corporate leaders note that America's declining competitive strength is driven in part by the failure to prepare children adequately to contribute to the workforce. Several years ago the Committee on Economic Development (CED), an independent research and education organization comprised of over 100 business executives and educators, released a statement on the benefits of quality education and the cost of educational failure. In it they said:

> "Effective solutions to the problems of the educationally disadvantaged must include a fundamental restructuring of the school system. But they must also reach beyond the traditional boundaries of schooling to improve the environment of the child. An early and sustained intervention in the lives of disadvantaged children, both in school and out, is our only hope for breaking the cycle of disaffection and despair."

The CED statement urges policymakers "to look beyond traditional classroom boundaries and provide early and sustained intervention in the lives of children." In keeping with the goals of CED, groups of corporate executives from major U.S. companies testified before Congress in 1991 and 1992 to support programs and legislation that address growing hunger and poverty among children.

Data on the threat posed by childhood undernutrition has never been so definitive. This knowledge suggests that new approaches may provide even greater protection from the peril of undernutrition associated with poverty. Scientific understanding of this relationship will continue to improve. But we now know enough to formulate more effective ways to protect our children and, in so doing, strengthen this nation and its future.

Methodology

This document was prepared through a comprehensive review of recent scientific literature on the relationship between nutritional status and cognitive development during childhood. An effort was made to focus the review on research conducted where malnutrition most closely resembles the type seen in the United States.

Although some studies on the relationship between cognitive development and nutritional intake are inconclusive or open to discussion about methodology and research design, this review highlights themes that appear consistently throughout the literature.

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About the Center

The Center on Hunger, Poverty and Nutrition Policy was established at Tufts University in 1990. Its purpose is to promote public policy choices which reduce hunger and poverty and enhance the development and productive capacities of American families and children. The Center carries out policy research and analyses, and works with governmental leaders and the media to promote greater understanding of policy alternatives for the nation.

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